A New Subspecies of *Plebejus acmon*

(Lepidoptera: Lycaenidae)

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Plebejus acmon (Westwood & Hewitson) and *Plebejus lupini* (Boisduval) are closely related, variable species characterized by conspicuous sexual dimorphism, a well marked orange or pink hind wing band, and use of *Eriogonum* as foodplant. A recent biosystematic study of this complex and of an additional related species, *P. neurona* (Skinner), suggests that biological relationships are unusually complex. Morphological intergradation, apparent character displacement, and wing pigmentation polymorphism complicate analysis of variation. Discussions of regional morphological and biological differentiation within and intergradation between *P. acmon* group members is presented elsewhere (Goodpasture, 1973a).

The purpose of the present paper is to describe a new entity of the *P. acmon*-*P. lupini* species complex from the southern Rocky Mountain region. The new entity is considered conspecific with *P. acmon* because of morphological intergradation with this species. Recognition of this entity as a subspecies clarifies patterns of variation in this complex.

Plebejus acmon texanus Goodpasture, new subspecies

Male.—Forewing length (straight-line distance from base of costa to apex of M_1) of type series $\bar{x} = 11.2$ mm ± .45 mm[1] ($N = 13$); Type 12.3 mm. *Dorsal wing surface* (Fig. 12).—General wing color created by more or less continuous sheet of iridescent cyanic scales overlying dark scale subsurface. Overlay color purple of low saturation and brilliance. Approximate hue[2] of iridesence of cyanic overlay Purple-Blue Purple. Black band at apical margin of primary moderately broad with few black scales extending basally along veins. Transition of black marginal band on primaries with cyanic overlay scales gradual. Numerous dark scales scattered over wing surface. Indistinct row of dark scales present at apex of discal cell. Distal insulae of secondaries well separated from terminal line. Submarginal band on secondaries orange, appearing rose when viewed from certain angles, bordered basally by few dark scales. *Ventral wing surface.*—Dark gray ground color; black spots encircled by distinct ring of white scales; submarginal orange band broad. *Genitalia.*—Uncus lobes as seen in dorsal view blunt, not strongly spatulate; in lateral view, small and quadrate as in Figs. 2 and 5.

Female.—Forewing length of type series $\bar{x} = 11.0$ mm ± .61 mm ($N = 14$);

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[1] Standard deviation.

[2] Color terminology follows the Munsell book of color (Anonymous, 1942. Munsell Color Co., Inc., Baltimore, Md., 145 pp.).

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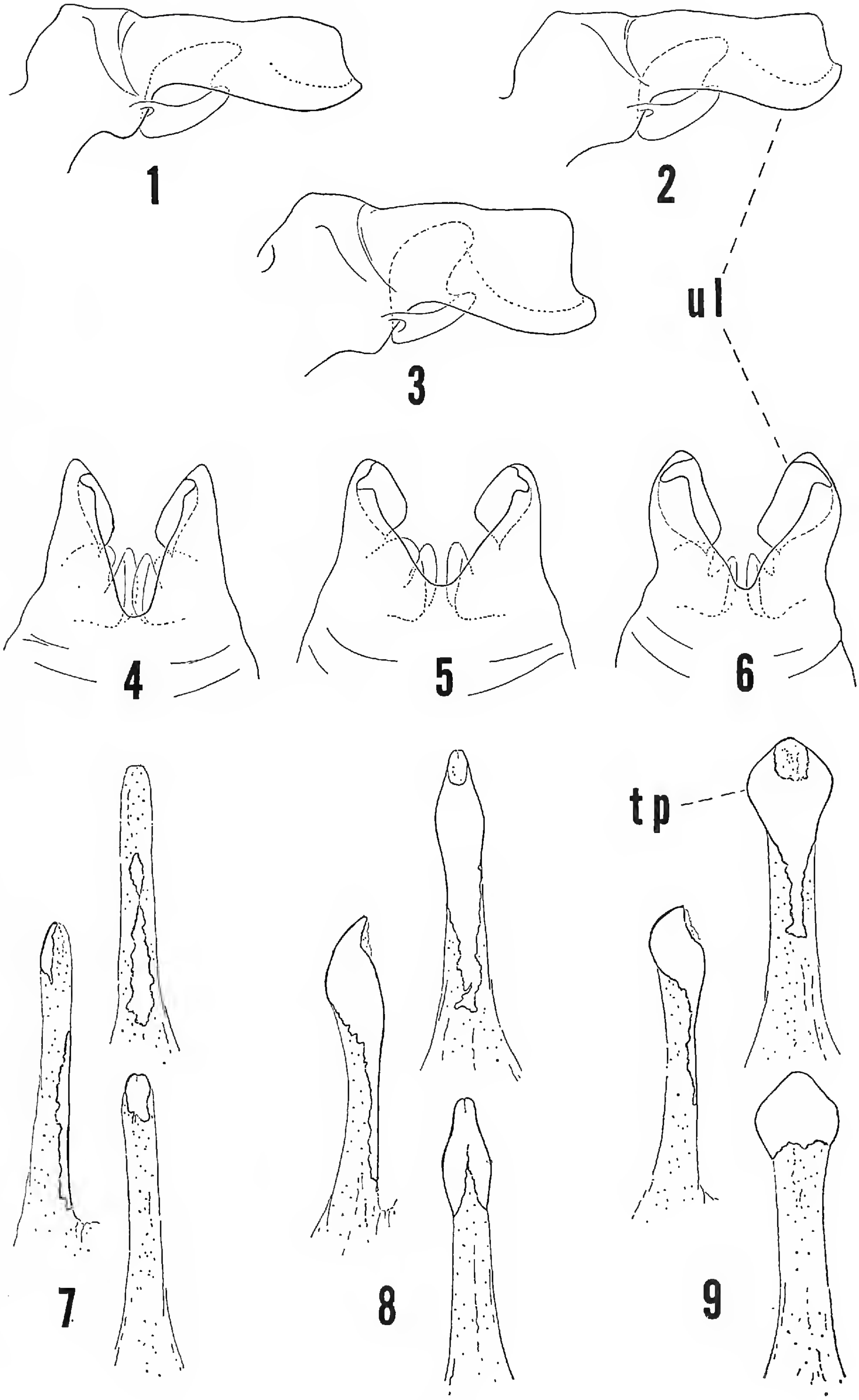
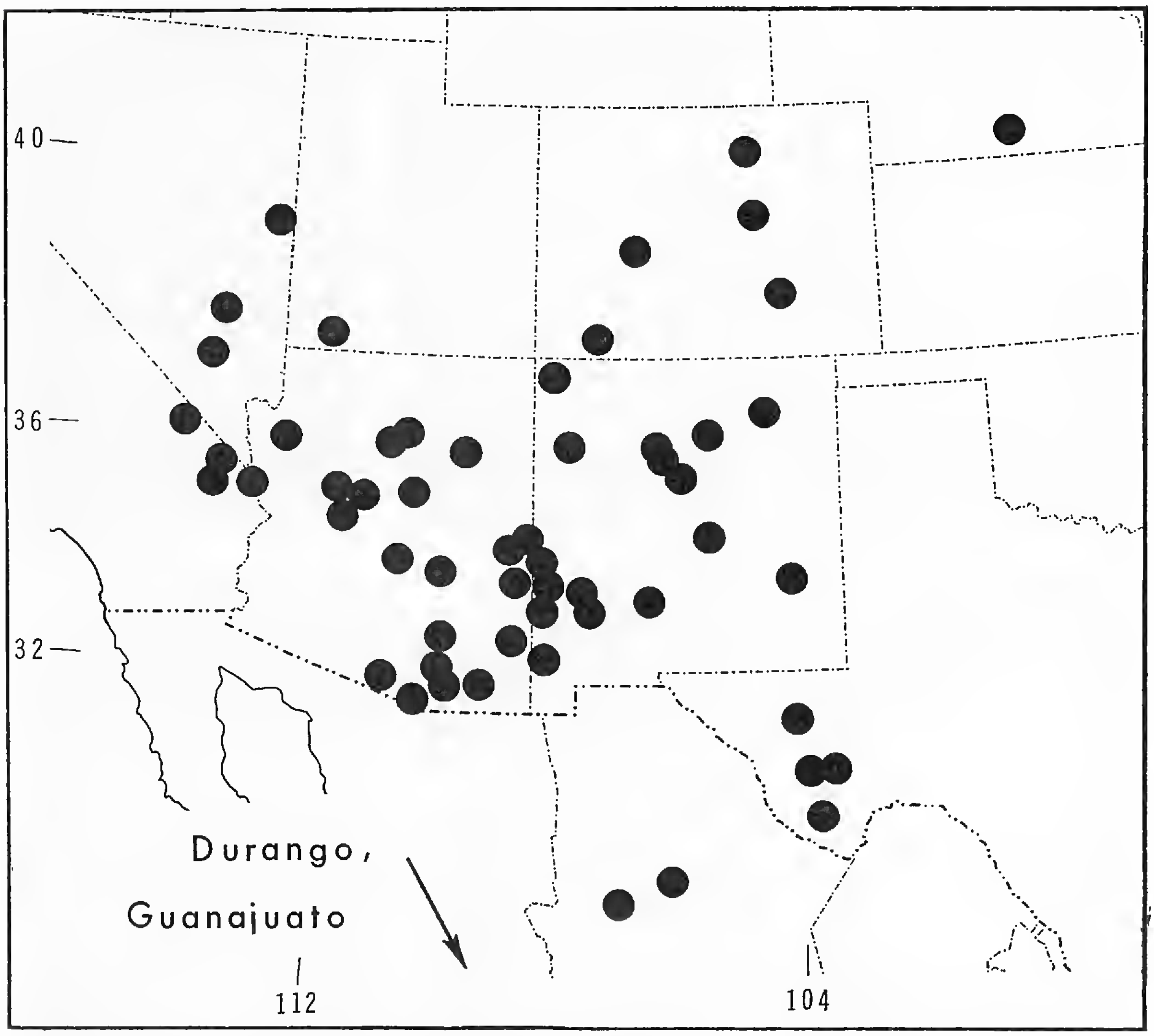


FIGS. 1–9. Genitalia of species of the *Plebejus acmon* complex: Uncus of male, lateral view (1–3) dorsal view (4–6). Sterigma of female (7–9), dorsal (upper),



Map 1. Distribution of *Plebejus acmon texanus*.

Type 11.7 mm. *Dorsal wing surface.*—Basal one-fifth covered by cyanic overlay. Color and iridescence of overlay as in male. *Ventral wing surface.*—As in male except ground color gray with brownish cast. *Genitalia.*—Sterigma heavily sclerotized, swollen and pointed apically; terminal plate extending basally onto dorsal surface of sterigma as in Fig. 8.

Holotype male and allotype, 1 mi. S. Hillside, Yavapai Co., Arizona, 30 September 1969, J. A. Scott. Deposited in the Los Angeles County Museum of Natural History, Los Angeles, California. Topoparatypes: 12♂, 13♀, 30 September 1969; 2♀, 21 September 1971, C. E. Goodpasture.

Geographical distribution (Map 1).—Arizona, New Mexico, western Texas, westcentral Mexico, parts of Colorado, Utah, Nevada, and extreme

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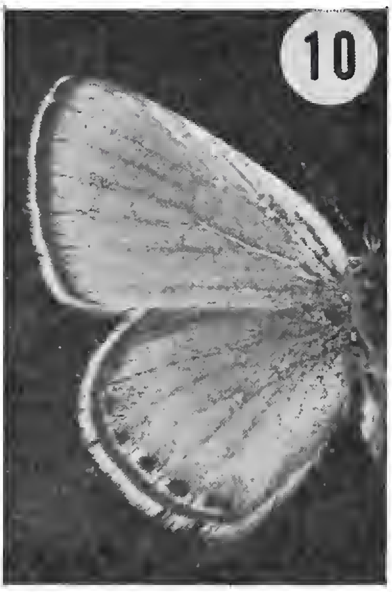
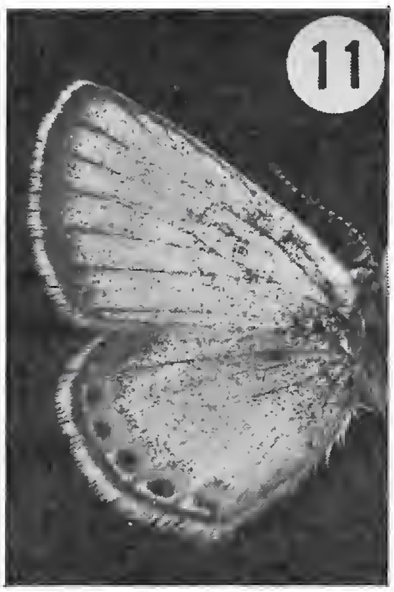
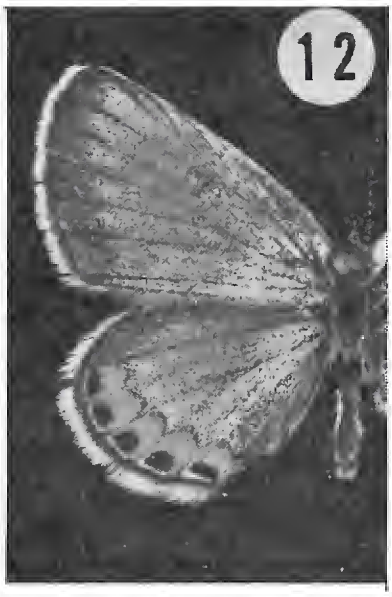
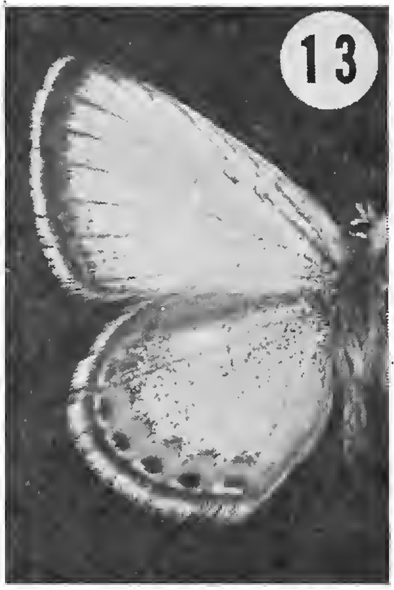
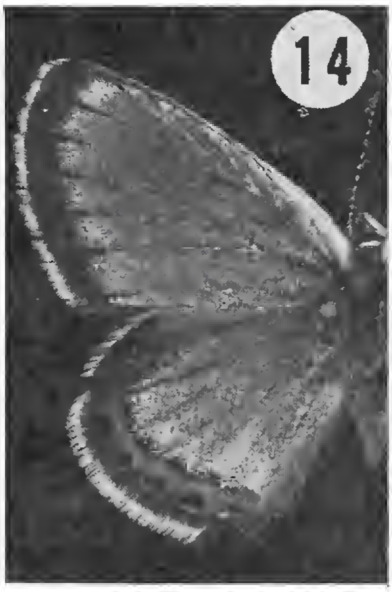
ventral (lower), and lateral (center) views. Figs. 1, 4, 7. *Plebejus acmon acmon.* Figs. 2, 5, 8. *P. acmon texanus.* Figs. 3, 6, 9. *P. lupini.* ul = uncus lobe, tp = terminal plate.

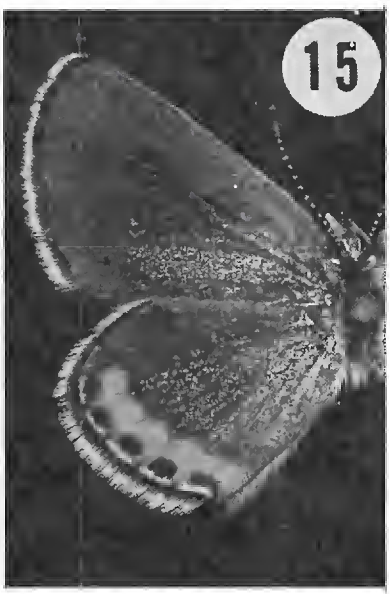


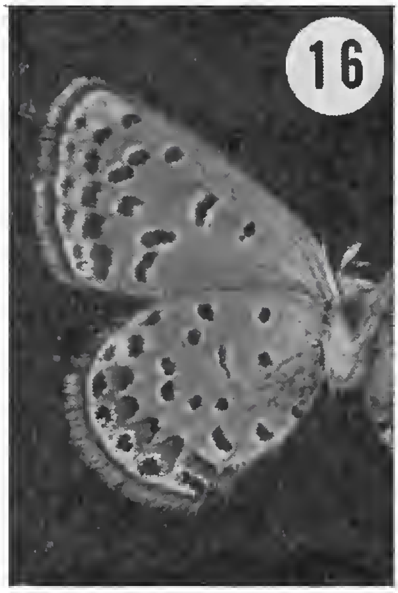


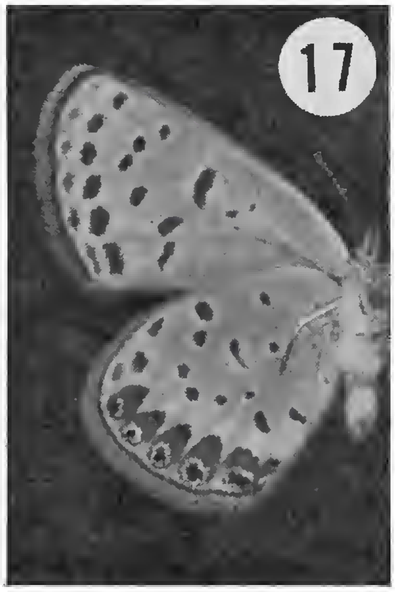


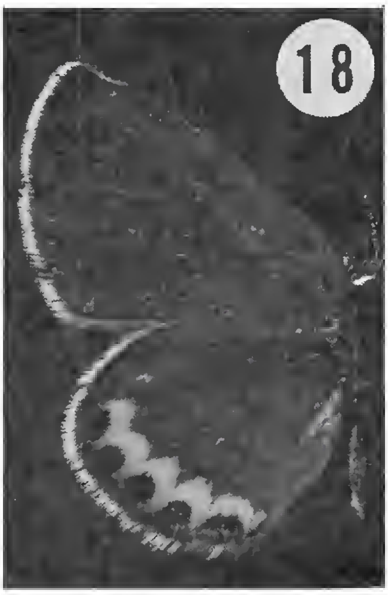




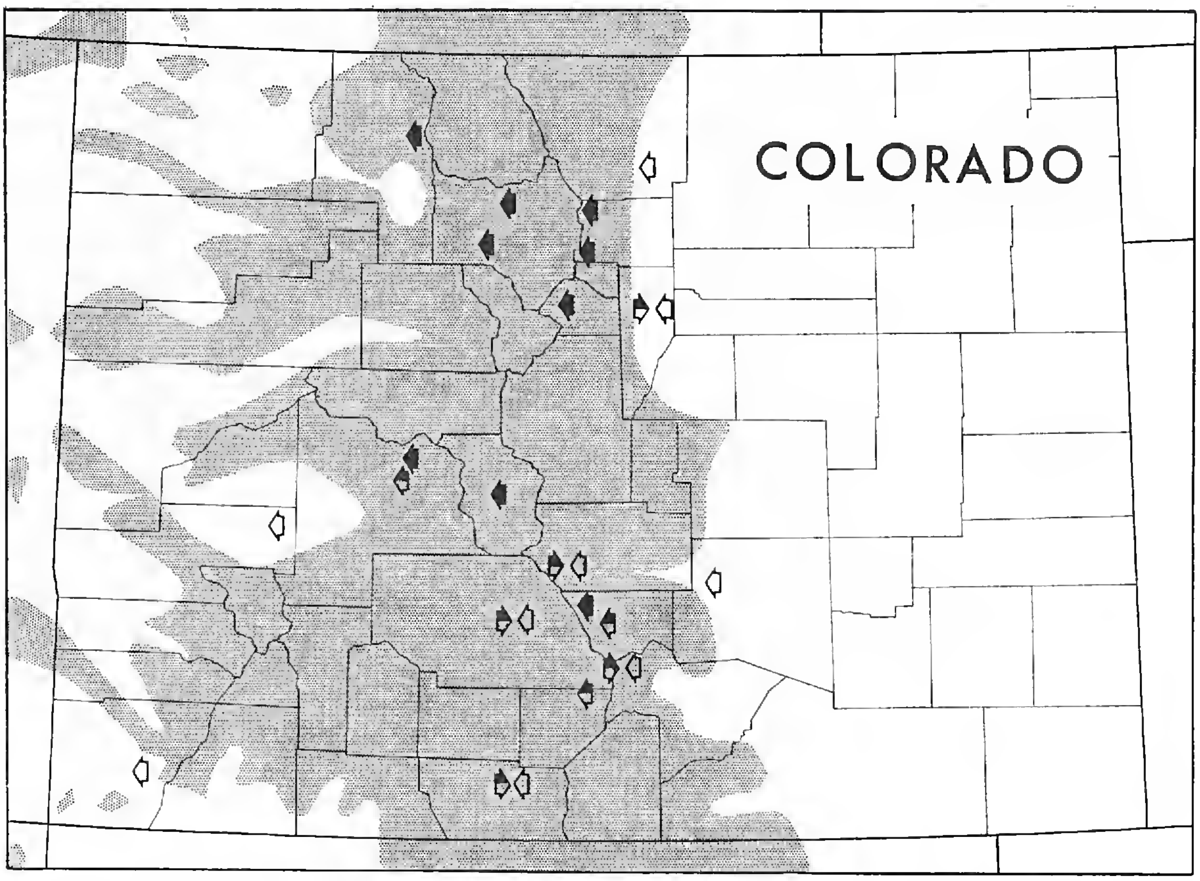








FIGS. 10–14. Wing upper surface patterns of males of the *Plebejus acmon* complex. FIG. 10. *P. acmon acmon* Briceberg, Mariposa Co., California, 5 May 1969, K. C. Hughes. FIG. 11. *P. acmon lutzi* Pole Mtn., Albany Co., Wyoming, 4 July 1970, C. D. Ferris. FIG. 12. *P. acmon texanus* Holotype. FIG. 13. *P. lupini monticola* Sierra Pelona Road, Mint Canyon, Los Angeles Co., California, emgd. 12 May 1970, C.



Map 2. Distribution of *Plebejus acmon texanus* (open arrows), *P. acmon lutzi* (filled arrows), and *P. acmon texanus-P. acmon lutzi* intermediates (divided arrows) in Colorado. Where arrows point to one locality, more than one phenotype occurs. Shading roughly denotes areas above 7,000 feet.

southeastern California. Occurring most commonly in mountains below about 9,000 feet. In southeastern and eastcentral Arizona, Brown (1965) notes Upper Sonoran through Transition zones; elevations 4,000–7,500 feet. In Colorado, *P. acmon texanus* occurs at elevations between about 6,000 and 7,000 feet. At higher elevations, phenotypic blending with *P. acmon lutzi* occurs (Map 2).

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E. Goodpasture. Fig. 14. *P. lupini lupini* Echo Lake, El Dorado Co., California, 8,000 ft., 10 July 1970, C. E. Goodpasture. Note that darkness of photograph represents darkness of wing color: lightest blue (Fig. 13) = lightest gray; darkest purple (Fig. 14) = darkest gray. Figs. 15–18. Wing patterns of females: uppersurface Figs. 15 and 18, undersurface Figs. 16 and 17. Fig. 15. *P. acmon texanus* National forest boundary, road to Mt. Lemmon, Pima Co., Arizona, 8 April 1966, J. A. Scott. Fig. 16. *P. acmon texanus* 21 mi. S Alpine, Brewster Co., Texas, 20 September 1970, J. A. Scott. Fig. 17. *P. acmon acmon* Monticello Dam, Yolo Co., California, emgd. 1 May 1970, C. E. Goodpasture. Fig. 18. *P. lupini lupini* 5 mi. N Sun Pass, Klamath Co., Oregon, 18 July 1971, C. E. Goodpasture. All figures × 2.2.

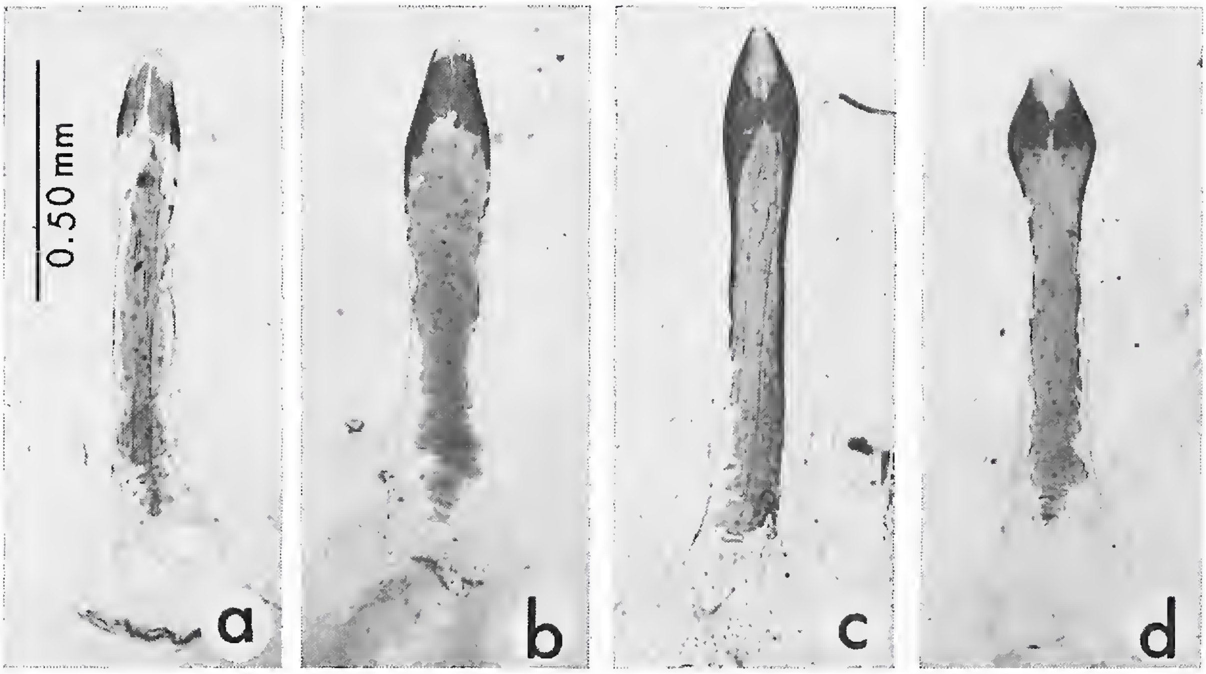

FIG. 19. Variation in sterigma of females of *Plebjus acmon* from Schillings Spring, Conejos Co., Colorado. Morphology as in *P. acmon* (a); *P. a. texanus*-*P. a. lutzi* intermediate (b); *P. a. texanus* (c); similar to *P. lupini* (d).

MATERIAL EXAMINED (600 specimens).—Locality data is given for representative material from throughout the range of *P. acmon texanus*. Genitalia slide mounts were made of all specimens listed. Specimens intermediate in genital morphology between *P. acmon texanus* and *P. acmon lutzi* are indicated.

ARIZONA: *Apache Co.*: Alpine, 7 June 1937, 1♂; Turkey Creek Rd., White Mts., 20–21 June 1935, 1♀. *Cococino Co.*: 7 mi. SW Williams, 26 July 1970, 1♀; Pine Flat Campground, 11 April 1963, 1♀. *Greenlee Co.*: Hannagan Meadow, White Mts., 22–27 June 1937, 4♂, 3♀. *Mojave Co.*: Hualapai Mts., 6 September 1964, 3♀. *Pima Co.*: Mt Lemmon, 8 April 1966, 1♀; 20 mi. NE Tucson, 4,200 ft., 23 October 1960, 1♂. *Yavapai Co.*: 1 mi. S Hillside, 30 September 1969, 2♀. CALIFORNIA: *San Bernardino Co.*: New York Mts.: 1 June 1968, 4♂, 1♀; Keystone Canyon, 7 mi. SE Ivanpah, 5,000 ft. and 5,500 ft., 23 September–8 October, 1♂, 2♀; ¾ mi. SE Horse Thief Springs, Kingston Range, 4,400–4,800 ft., 29 June 1969, 2♂; Gilroy Canyon, Providence Mts., 21 April–30 May 1968, 2♂. COLORADO: *Alamosa Co.*: Great Sand Dunes Nat'l. Monument, 12 June 1945, 2♂ (intermediate). *Conejos Co.*: ½ mi. SE Schillings Spring, 9 July 1967, 5♀ (2 intermediate); W end of Alamosa Reservoir, 9 July 1967, 2♀. *Custer Co.*: Baldy Peak, 12,000 ft., 29 July 1970, 2♂; Hermit Pass Rd., 22 July 1968, 1♂, 1♀; 1.5 mi. NW Westcliffe, 25 July 1965, 3♂, 1♀. *Fremont Co.*: Bear Creek, 22 June 1970, 1♀; Hillside School, 16 August 1968, 2♀. *Gunnison Co.*: 9 mi. N Crested Butte, 26–29 July 1966, 1♂ (intermediate); Gothic, 31 August 1961, 1♂ (intermediate); Taylor River, 10 July 1961, 1♂ (intermediate). *Huerfano Co.*: 7 mi. W Malachite, 4 July 1970, 1♂. *Jefferson Co.*: 1 mi. W Golden, 10 September 1965, 2♂; Phillipsberg, 4 September 1961, 1♂ (intermediate). *Larimer Co.*: Round Butte, 29 June 1964, 1♂, 1♀. *Montezuma Co.*: Mesa Verde Nat'l. Park, 22 July–1 September, 1♂, 1♀.

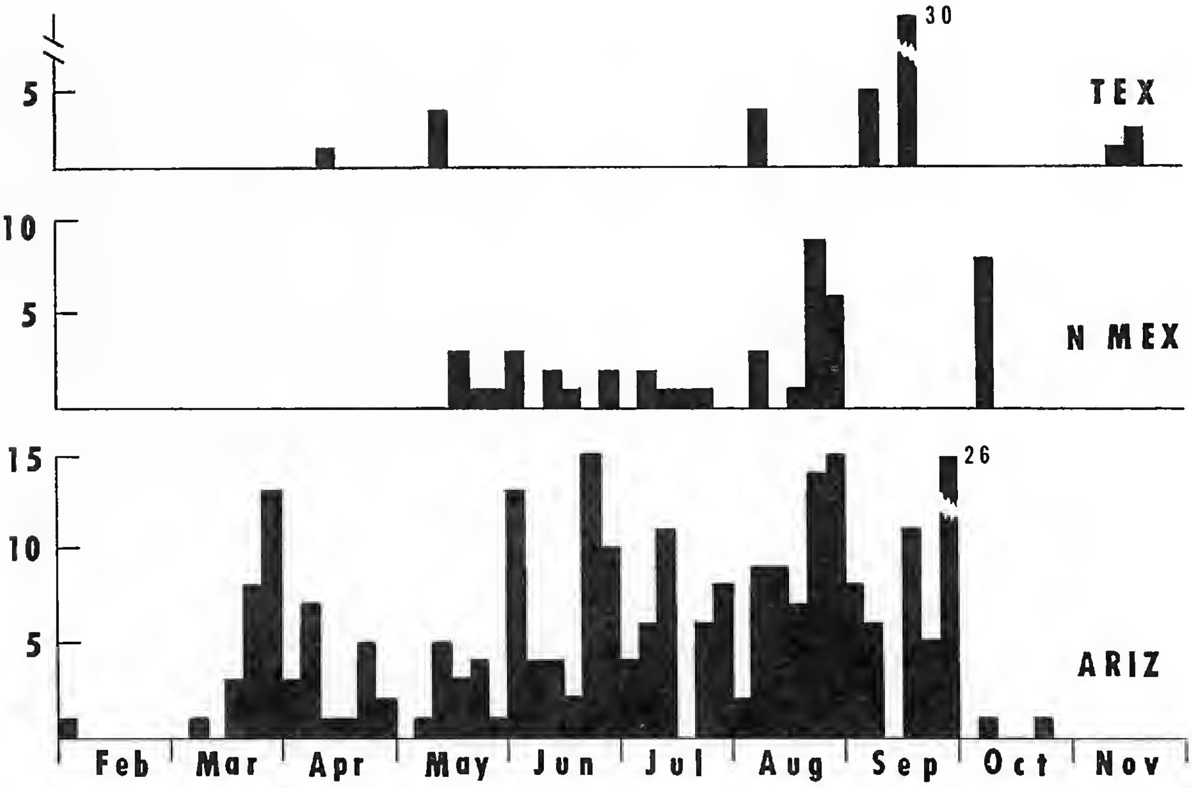

Fig. 20. Seasonal distribution of *Plebejus acmon texanus.*

Pueblo Co.: SW of Pueblo, 31 July 1962, 1♂. *Saguache Co.*: Mosca Pass Trail, 8,500 ft., 10 July 1970, 3♂; 1 mi. SW Villa Grove, 17 June 1966, 1♂. New Mexico: *Mora Co.*: 8.5 mi. E Wagon Mound on Hwy 120, 16 August 1970, 1♀. *McKinley Co.*: 4 mi. S Fort Wingate, 10 July 1966, 1♀. *Sandoval Co.*: Sandia Mts. 8,500 ft., 3 June 1945, 1♀. *Sante Fe Co.*: Cerrillos, 17 August 1970, 1♀. *Torrance Co.*: Manzana Mts., 2 June 1945, 1♀. Nebraska: *Phelps Co.*: Atlantic, 23 July 1964, 1♂. Nevada: *Douglas Co.*: 1.5 mi. E Glenbrook, 4 June 1970, 1♂. *Clark Co.*: Sheep Range, 3–4 mi. NW Mormon Well, 1–2 July 1969, 1♂ 1♀. *Lincoln Co.*: 10 mi. W Caliente, 6,200 ft., 3 July 1969, 1♂. *White Pine Co.*: 1 mi. S Blind Spring, W end Snake Range, 5,800 ft., 29 July 1969, 1♂. Texas: *Brewster Co.*: 21 mi. S Alpine, 8 August–20 September, 3♂, 4♀. *Jeff Davis Co.*: Fort Davis, 13 May 1962, 1♀. Utah: *Washington Co.*: Zion Nat'l. Park, 15 June 1938, 1♂, 1♀. MEXICO: Chihuahua: 17 mi. W Chihuahua and 7 mi. E Pedernales, 7,900 ft., 11 July 1964, 2♀. Durango: 22 mi. E El Salto, 8,000 ft., 22 July 1964, 1♂. Guanajuato: 10 mi. N Guanajuato, 4 July 1954, 1♂.

Seasonal distribution (Fig. 20).—Multivoltine; collection records indicate that flight season extends from early spring to late summer. Data from Fig. 20 suggest multimodality of seasonal abundance with one peak in spring and another in late summer. Separate spring and summer flight periods(March-April and mid-August-September) are reported for southeastern Arizona; elevation 4,000–6,000 feet (Brown, 1965).

Foodplants.—Certain perennial, bush-like *Eriogonum* species. Oviposition has been observed on *Eriogonum wrightii* var. *wrightii* Torr. ex Benth. at Hillside, Yavapai Co., Arizona and on *E. racemosum* Nutt.

TABLE I. Major differentiating characters for the *Plebejus acmon*-*P. lupini* complex. Color terminology follows the Munsell book of color (Anonymous, 1942).

Character	*a. acmon* and *a. lutzi*	*a. texanus*	*l. lupini* and *l. monticola*
Male genitalia:			
Shape of lobe of uncus in lateral view.	Small and angulate (Fig. 1).	Small and quadrate (Fig. 2).	Large and strongly quadrate (Fig. 3).
Uncus in dorsal view	Sharply pointed (Fig. 4).	Intermediate (Fig. 5).	Blunt (Fig. 6).
Female genitalia:			
Shape of sterigma.	Tubular (Fig. 7).	Apically bulbous, sharply pointed (Fig. 8).	Apically heart to spade shaped (Fig. 9).
Sclerotization.	Entirely membranous or partly sclerotized. Terminal plate incomplete, confined to ventral apex of sterigma.	Terminal plate complete, extending basad along dorsal surface of sterigma.	As in *texanus* except basad extension sometimes lacking.
Wing pigmentation (dorsal):			
1. Marginal band on FW of males.	Reduced to a thin terminal line (Fig. 10) in *acmon*. Broad in *lutzi*, very broad in melanic *lutzi*.[1]	Broad (Fig. 11) or broader than as in Fig. 12.	Broad. Very broad in melanic *lupini*.
2. Basad extension of marginal band along FW veins of males.	Absent or faint. Prominent in melanic *lutzi*.	Prominent (Fig. 12).	Prominent in *lupini*. Faint in *monticola*.
3. Marginal band-overlay transition of males.	Abrupt (Figs. 10, 13). Gradual in melanic *lutzi*.	Gradual (Fig. 12).	Gradual in *lupini*. Abrupt in *monticola*.
4. Approximate hue of iridescence of cyanic overlay.	Purplish Purple-Blue to Purple-Blue Purple. Purple-Blue in some Nevada, Utah and Idaho *lutzi*.	Purplish Purple-Blue to Purple-Blue Purple.	*lupini* as in *texanus*: tending toward Blue Purple-Blue E. of the Sierra Nevada. *monticola*: Blue Purple-Blue to Purple-Blue in S. Calif. (= type *monticola*), Greenish Blue-Green to Blue-Green in some Kern & L. A. Co. specimens (= type *chlorina*); usually as in *texanus* and *lupini* in San Diego Co. south.

TABLE I. (Cont.)

Character	*a. acmon* and *a. lutzi*	*a. texanus*	*l. lupini* and *l. monticola*
5. Distal insulae of HW of males.	Separate from terminal line. Fused with terminal line in melanic *lutzi*.	Separate from terminal line.	Usually fused with terminal line in *lupini*. Usually separate in *monticola*.
6. Color of submarginal band on HW of males.	Pink in *acmon*. Orange in *lutzi*.	Orange.	Orange.
7. Border proximal to submarginal band.	Absent in *acmon*. Usually present in *lutzi*.	Present	Present in *lupini* except at low elevations E. of the Sierra Nevada. Usually present in *monticola*.
8. Dark scales at apex of FW discal cell in males.	Absent in *acmon*. A few scales in *lutzi*.	Distinct scale patch.	Absent in *monticola*. *lupini* as in *lutzi*.
9. Dark scales scattered over wing surface.	Absent or few. Many in melanic in *lutzi*.	Many.	Absent or few. Many in melanic *lupini*.
10. Color of forewing in males.	Purple of high saturation and brilliance in *acmon*. Purple to Blue, usually of high saturation and brilliance in *lutzi*.	Purple of low saturation and brilliance.	*lupini* as in *texanus*. *monticola*: as in *lupini* to Blue (type *monticola*) or Blue Green (type *chlorina*) of high saturation and brilliance, sometimes largely brown in Tehachapi Mts., S. Calif.
11. Range in percent of wing surface covered by overlay in females.	90 to 0 in *acmon*, highest in overwintering and spring generations (= type *cottlei*) 25 (Fig. 15) to 0 (Fig. 18) in *lutzi*.	As in *lutzi*.	25 to 0 in *lupini*. 90 to 0 in *monticola*, highest in L. A. Co., Calif. (= type *monticola*).

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[1] Melanic specimens of ***P. acmon lutzi*** and ***P. lupini lupini*** are extensively dark scaled and are similar or identical in wing characters. Known from higher elevations and more northern latitudes.

at Mesa Verde National Park, Montezuma Co., Colorado. Associations of adults with *E. effusum* Nutt. in Colorado and *E. corymbosum* var. *velutinum* Reveal & Brotherson in New Mexico suggests that these plants are also utilized. More complete data on foodplant use are given elsewhere (Goodpasture, 1973b). The type series was collected in association with *E. wrightii* var. *wrightii.*

DISCUSSION

Morphological character combinations that differentiate *P. acmon texanus* from other members of the *P. acmon-P. lupini* complex are summarized in Table I. Variability of the diagnostic characters listed is least in morphology of female genitalia and greatest in uppersurface wing patterns of males. It should be noted that females lack diagnostic external characters. Species designations of *P. acmon* group females can not be made without examination of the genitalia. Subspecies assignments within *P. acmon* and *P. lupini* usually require series of both sexes.

In external phenotype *P. acmon texanus* closely resembles *P. lupini lupini* in uppersurface wing color (characters 6 and 10 of Table I), forewing marginal band (3, 4 and 5), color of hindwing submarginal band (8) and presence of a dark border proximal to hindwing submarginal band (9). These two subspecies differ primarily in intensity of expression of characters. For example, on the uppersurface of the primaries, discal scale spot and basad extension of marginal band scales along veins are strongly expressed in *P. acmon texanus* and weak or absent in all but strongly melanic *P. lupini lupini.* It is of interest that at least one high elevation population (Mono Pass, California) of *P. lupini lupini* is composed largely of individuals pigmentationally indistinguishable from *P. acmon texanus.* Of ten male wing pigmentation characters listed in Table I, at least nine are shared by some specimens of both *P. acmon texanus* and *P. lupini lupini,* whereas approximately six characters are shared with *P. lupini monticola,* and *P. acmon lutzi* and only one or two with *P. acmon acmon.*

Genital morphology in *P. acmon texanus* appears intermediate between that of *P. acmon* and *P. lupini.* Genital characters most consistently differentiating these two species are in males, the uncus, and in females, the extensible ostium bursa (sterigma). The sharply pointed terminal plate of *P. acmon texanus* is unique among *P. acmon* group members.

Plebejus acmon texanus is treated as a subspecies of *P. acmon* rather than of *P. lupini* which it most closely resembles because of the occurrence of intergradation with *P. acmon* in at least some areas between the ranges of the two entities. In Colorado, several populations include individuals that are morphologically intermediate between *P. acmon texanus* and *P. acmon lutzi*. At these localities variation in genital morphology is unusually great. For example, at Schillings Spring, sclerotization of the extensible organ in females ranges from complete as in *P. acmon texanus* to incomplete as in *P. acmon acmon* and *P. acmon lutzi* (Fig. 13). Localities in Colorado where pigmentational and/or genitalic intermediates have been collected are shown in Map 2. A "blend zone" following an altitudinal as well as a geographic gradient is indicated by the data plotted. Whether or not this apparent zone of intergradation and marked variation occurs in other areas between the ranges of *P. acmon texanus* and *P. acmon lutzi* is unknown.

At the extreme western edge of the distribution of *P. acmon texanus*, a different situation may exist. Small series of *P. acmon* examined from desert mountains of southeastern California include both *P. acmon texanus* and *P. acmon acmon* but not intermediate phenotypes. Further collecting at these and other localities at the margins of the distribution of *P. acmon texanus* is needed to help clarify these situations.

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